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ABSTRACT

This paper describes various types of distance education technologies and their use in rural Australia. Communications and information technologies may be categorized as distributive or interactive. Correspondence education is a distributive form of distance education, involving the postal service and, at times, educational television or radio. This mode has been considered second-best because of long lags in feedback and the lack of live interaction. Interactive technologies include teleconferencing, computer mediated communication, and in-house multimedia systems. Teleconferencing includes audioconferencing (voice-only telephone links), audiographics conferencing (transmission of voice plus graphics using telephone or narrow-band telecommunications), computer text conferencing, interactive satellite television (requiring a transmitting studio and satellite receiving dishes), analogue videoconferencing (interactive visual and audio communication using television transmission systems), and compressed videoconferencing (digitization and compression of video input to allow transmission through the telephone network). Examples are provided of Australian programs and applications of these technologies. Computer mediated communication includes electronic mail, electronic bulletin boards, access to libraries and databases via Internet, computer text conferencing, and file transfer. Interactive multimedia courseware may be delivered by laserdisk, CD-ROM, or online servers. Criteria for choosing technology delivery options are discussed that consider the needs of learners, program objectives and content, teacher skills, and costs and feasibility. Applications are listed for education, administration, support services, access to resources, research, and entertainment. (SV)

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

RURAL ISOLATION: TECHNOLOGIES FOR THE DELIVERY OF EDUCATION AND TRAINING

Roy Lundin — Australia

ABSTRACT

In spite of there being talk of a shrinking planet and of the global village, there remain several limitations to the delivery of education and training in the rural and isolate areas of Australia. There are, however, continual developments in communications and information technologies, coupled with decreasing costs, and in the response of educational institutions which should provide all people regardless of location with easy and full access to education and training opportunities. What are these developments? What are the social and economic pressures which require that this access be provided? What are the infrastructures that need to be developed to ensure access? What are the barriers to such access? This paper will provide an overview of the delivery options that exist and raise the issues related to these questions for all participants in the group to discuss.

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1. TYPES OF TECHNOLOGY OPTIONS FOR FLEXIBLE DELIVERY

Some common concepts and terminology are required to ensure a common understanding of the discussion in this paper. Because this is an emerging field, a variety of terminology is evolving for the same kinds of technology and practices. The following definitions and descriptions are based on examples from the literature and practice in Australia and overseas.

Each type of technology or medium has specific attributes which give it its power or effectiveness for certain purposes. Knowledge of these attributes will enable teachers and professional development program providers to design learning activities with strategies that make the most of these unique attributes. It is on this basis that categories and definitions must be formulated.

The term 'technology' has several uses in everyday language. It is frequently used to include the hardware that we design, construct and use – the artefacts of our society. It is also used to describe a class of processes that are algorithmic in nature – techniques for achieving certain outcomes. Frequently, these processes are used to produce artefacts/hardware. A third use is concerned with forms of organisation – networks, business and manufacturing structures that exist to support the production of artefacts and the use of algorithmic processes. These forms of organisation (global corporations, assembly lines, quality circles, etc) only exist because of the artefacts and processes. The three 'forms' of technology are symbiotic in nature, each feeding on and supporting the others.

There are two main categories of communications and information technology:

- distributive
  - postal services
  - broadcast radio
  - broadcast television
  - narrowcast radio or television
  - simulcasting
- interactive
  - telecommunications-based interactive communications and information technology such as teleconferencing (audio, audiographic and video),
  - computer-mediated communication(CMC), both real time (synchronous) and delayed (asynchronous), such as email, bulletin boards, computer-text conferencing, listservers, file transfer, access to databases and so on,
  - in-house workstation or computer-based Interactive Multimedia (IMM) systems, including laser disk and CD- ROM systems.

'Distributive' implies one way delivery with no immediate interaction between teacher/presenter and learners or among learners. What interaction that may occur is limited and usually subject to considerable delay. 'Interactive' refers to delivery modes which provide for immediate interaction among all participants in various ways, although with computer-mediated communication (CMC) this is usually asynchronous and therefore slightly delayed, but this can be seen as an advantage of this mode. With IMM, 'interactive' refers to the extent to which the user can engage with the courseware, and the nature of that engagement.

These types of technology are classified in this manner because of the implications of each category for design, production, delivery and costs of programs, particularly in terms of pedagogy and support services. The two categories, however, are not mutually exclusive in that various media may be combined, and the same transmission conduits can be used for both general educational and non-educational purposes, as well as for distributive and interactive programs.

2. DISTRIBUTIVE MODES

Correspondence education, on its own, has been found to be a second-best method of teaching for several reasons:

- There is a complete dependence on written correspondence lessons being sent to students by post, which results in a time lag of three to six weeks for the turn-around time for feedback on assignment work, or for requests for books from a library.
- There is little or no opportunity for live interaction between students and lecturers or students and students, except for individual telephone calls often at student expense, (and this is often impossible during daytime in any case), costly vacation/residential schools in some cases, or expensive lecturers' visits to regional centres.
- There is little or no opportunity for students to benefit educationally from live group interaction with their colleagues enrolled in the same subject.

What has occurred over the years is that 'correspondence' education was provided as a second best alternative for students not able to attend school or tertiary institutions simply because of geographical distance. Then it became possible to use audiovisual, communications and information technology to enhance those correspondence courses. Also, adequate, specially selected 'readings' were included to ensure there was less disadvantage due to not having access to a library. This may be described as a 'deficiency' model of distance education, where the use of resources/technologies was an attempt to make up for what was being missed by 'external' students not able to attend live classes. In recent years, however, distance education has attained a value added model which has to some extent resulted in the 'internal' or on-campus students actually being disadvantaged due to not having easy access to these same well-prepared resources. For this reason, the distance education/open learning/flexible delivery approach is now seen as being as applicable to on-campus students as for off-campus students.

Broadcast radio and television have been used for the delivery of both formal and informal education and training for many years around the world. In addition to broadcast, there is narrowcast radio or television which is so called because the transmission is aimed at a specific group of people rather than to the public, in general. There is also the enhancement of providing both radio and television programs simultaneously, presumably to enhance the audio, which is referred to as simulcasting.

There have been two significant developments in Australia with regard to broadcast television. Firstly, the Open Learning Agency of Australia Ltd. (OLAA), which was established through Monash University with federal government funding, uses the ABC for the broadcast television delivery of several of its undergraduate university subjects. The major advantage of this is that the ABC is the only delivery agency of its kind, in addition to Australia Post, which can provide nearly 100% coverage of the Australian population and, therefore, provide the most comprehensive access. In addition, as a result of the ABC's venture into South East Asia using the Indonesian Palapa satellite, these courses are now destined for overseas delivery. The second initiative is the Wollongong University Post-Graduate Education (PAGE) Consortium which has adopted the same kind of model as the OLAA using SBS for television transmission.

Normally, however, except for 'talk back' radio and television, this distributive mode assumes that there is no immediate interaction among presenters and learners, but there may be delayed interaction through correspondence and telephone, or there may be other opportunities for live interaction provided in the context of an overall program or as described above.

3. INTERACTIVE MODES

3.1 'Teleconferencing' is a generic term which encompasses all forms of interactive communication using electronic telecommunications between individuals and groups. In the early days of the technology this term included some reference to participants being at a distance from each other, and to a great extent this is still the case in most teleconferences, but geographic distance is no longer a main element or requirement for taking advantage of teleconferencing.

Following are brief descriptions of six types of teleconferencing.

3.1.1 Audioconferencing

Audioconferencing uses the telephone system for voice-only links between individuals and groups. There are various terms used for this type of teleconferencing such as a 'conference call' and, in the Australian media, a 'telephone hook-up'. The key items of equipment are loudspeaker telephones for hands-free and group participation at any given site and electronic bridges which connect any number of telephone lines together for simultaneous interaction.

The benefits, in terms of access, effectiveness and cost benefits for teaching, learning and organisational communications, have been well established throughout the world. It is the most accessible interactive medium available and it can provide major economies of scale if the programs are designed appropriately and there is adequate local support. Individuals and groups can be involved; subject specialists can be brought in for guest presentations; it is quicker to organise and set up than any other mode of delivery. When print, graphics and other audiovisual materials are provided, audioconferencing can be as complete as a face-to-face experience. Audioconferencing is also a major component of the 'audiographics' mode discussed below.

If the audioconferencing traffic warrants it, a school or cluster of schools may wish to consider purchasing its own audioconferencing bridge. This has been the case in Victorian state schools and the ACT Catholic schools. The 'ConferLink 6' bridge which links the calling site with five others can be purchased for about $9000. On top of this is the cost of the installation of five telephone lines (5 x $250 = $1250) and their annual rental, plus the cost of the calls made. A cost analysis will need to be undertaken to determine whether the audioconferencing traffic would warrant the purchase of a bridge. Each school should have at least one conference phone/terminal (about $500 to $1200 or $2000 each depending on type), as a first measure.

Many schools, both government and non-government, already have a loudspeaker telephone; some principals have them in their offices. There is no way of assessing how common these are in schools. In every community there can also be found such telephones and in many cases they can be borrowed for special occasions. All of the 37 Queensland Open Learning Centres and all Education and School Support Centres have audioconferencing facilities. In several regions, all state schools have been provided with loudspeaker telephones. All non-metropolitan state schools in SA have had loudspeaker phones for over 10 years (the 'DUCT', Diverse Use of Communication Technologies). Similar patterns can be found in the other states and territories.

Use of audioconferencing is widespread amongst schools throughout every other state for the whole range of applications. Teacher-librarians through the School Library Association of Queensland (SLAQ) began using audioconferencing for professional development programs in 1983 and have continued the practice, as well as extending it nationally, for government and non-government members alike. Also in Queensland, special applications with school students have included linking with children's' literature authors to interview them on their writings. Regional officers and Education Departments' head office personnel have been using audioconferencing regularly for almost 10 years. South Australian schools have been able to demonstrate its use for distance education in every aspect of the curriculum, including music, typing, LOTE, social studies, and so on, as well as for staff professional development.

Audioconferencing is one of the most feasible options for teaching and learning at a distance in terms of both cost and the preparation required for presenters and learners. Sharing of expertise among principals can commence immediately using this form of linking with minimal expenditure or reorganisation. Principals' associations should also consider making it policy that committees, project teams and other administrative/organisational groups use audioconferencing as a matter of course. Telecom's ConferLink service is the only public audioconferencing service available. There is the need for some training to ensure good practices are implemented from the start.

3.1.2 Audiographics conferencing

This mode also uses the telephone system or a very narrow band of telecommunications to transmit graphics and other visual images such as scanned still pictures. It is usually combined with an audioconference and may even use the same audio bridges for multipoint links, so that it has been referred to as 'enhanced audio'. Devices used include facsimiles, writing tablets or telewriters, electronic blackboards and whiteboards, freeze-frame or slow scan video, optical scanners and remote-controlled slide projectors. The latest addition is the 'Electroboard' or 'Liveboard' which permits interaction with a computer on a large touch-screen which can be multipointed through a data bridge.

In the past ten years most of these single-function units have become merged with integrated microcomputer systems which permit real-time multipoint sharing of graphics and other applications software among all participants. In some countries, including parts of Australia, the term 'telematics' has gained some prominence to refer to the audiographic configuration of microcomputer-facsimile-loudspeaker telephone as a teaching/learning station, although 'telematics' may refer to the whole range of telecommunications technology in some of the literature.

Computer-based audiographics provides the opportunity for real time (synchronous) graphics interaction combined with audioconferencing using the telephone network. This means that the cost of transmission is relatively low, but the preparation of materials is more involved than with audioconferencing alone and may require computer skills that are not commonly available. Also, because of the nature of computer-modem links, most software for audiographics provided for only a limited number of sites to be linked simultaneously. However, the MS-DOS *Vis-a-vis* software and the *Electroboard* system can link 32 or 64 sites simultaneously through a data bridge.

The Queensland Open Learning Network has provided audiographics systems in 20 of its Open Learning Centres, based on the *Vis-a-vis* software, and can provide a bridging service as well. The Queensland Rural Health Education Network has many sites equipped with the same system. About 300 Victorian schools have audiographic systems in place, based on the Macintosh-facsimile-loudspeaker telephone combination and this has been used extensively for curriculum sharing since 1988. Queensland has 23 classrooms with the same combination of technologies through a project called 'TeleLearning'. Western Australia is implementing the same system for the teaching of Japanese language for primary schools. The Northern Territory has a number of schools using Macintosh based audiographics systems as well. These state systems are using an Australian software product called *Electronic Classroom* to enable the Macintosh computers to interact in up to four locations simultaneously.

This form of audiographics is not only effective and feasible in the short term, it provides the basis for migration to desk-top computer videoconferencing as the technology evolves. That is, with the advent of computer-based videoconferencing at a relatively low price, it is likely that the audiographics functions will grow into and be used to support such videoconferencing rather than be seen as a service in its own right. This form interschool networking/sharing is therefore not only economical but will provide the basis for medium to long term developments in the technology.

Experience based on the TeleLearning trials in Queensland and the Telematics systems in Victoria found that the teachers and students involved had no difficulty in adjusting to this form of teaching/learning. Indeed it was determined that teachers who engaged in these projects found that their face-to-face classroom teaching improved significantly. Deakin University has adopted computer-based audiographics as part of their teacher training and have used it for teaching practice sessions.

Audiographics systems may be considered as a 'local' type of CMC in that they use similar technologies and can link in with the

general computer-mediated communication (CMC) and interactive multimedia (IMM) options which are discussed below. In the short term, it would be advisable for principals to look at audioconferencing and audiographics plus computer-mediated communications as the first steps to electronic networking.

3.1.3 Computer-text conferencing

This form of communication has been traditionally called 'computer conferencing', but at present it is usually restricted to text only and in this way it differs from computer-based audiographics and computer-based videoconferencing systems. It uses specialised software which provides several more functions and controls than electronic mail or bulletin boards, but it uses the same technology: that is, microcomputers and modems communicating using a local area network, specialised telecommunications or through the telephone system using a computer to manage the communication. Although some computer-text conferencing software permits synchronous (real time 'chat mode') communication, the difference between this and other forms of teleconferencing is that it is mainly asynchronous and this attribute gives it its power, especially for international conferencing and communication among busy professionals. This form of communication may also be included in computer-mediated communication (CMC) as indicated below.

3.1.4 Interactive Satellite Television

The one-way satellite delivery of live video with two-way voice interaction via the telephone system has been used widely overseas and in Australia for curriculum delivery and professional development. In fact, aside from print and face-to-face, interactive satellite is the single most used technology for delivery of all levels of education and training in North America and Europe.

The cost of satellite videoconferencing delivery is based on the satellite charge of about $2000 to $3000 per hour, plus the cost of hiring the transmitting studio and receiving venues. Costs can vary depending on the time of day and whether bulk time is purchased. Pre-production is far more involved and costly than for audioconferencing or compressed videoconferencing. The crucial question with regard to this mode of delivery is whether economies of scale can be achieved, and experience shows that an audience of at least 300 or more is needed to make this form of delivery cost-effective.

Skychannel is a major commercial national carrier for this type delivery with about 7000 receiving sites in the pubs and clubs across the country. The federal Department of Social Security also has a network in place comprising 120 receiving sites in their offices throughout Australia. In WA, the Golden West Network reaches about 98% of the population outside of Perth, and with the Edith Cowan University initiative the programs can be made available in the Perth region as well ('Perth Educational Television' – PET). Edith Cowan University now produces about four hours of teachers' professional development this way each Friday.

In Victoria, Telecom has acquired Vistel (previously the Victorian government service) and the Victorian Directorate of School Education has just committed $4 million to provide a receiving dish for every one of its 2000 schools. It intends to use this state system for staff professional development, corporate briefings/information and curriculum delivery. During 1993 the Victorian Directorate of School Education produced over 100 hours of programming, including a course for teachers of Japanese. Cost analysis on some of the programs reveals a cost of between $5.00 and $10.00 per teacher for this form of professional development with the outcomes being just as good as for face-to-face seminars and workshops.

The Open Training and Education Network (OTEN) in NSW is transmitting satellite programs to 70 TAFE sites and some nationally; the NSW Schools of Distance Education have merged with it and OTEN is now in the process of providing all forms of curriculum and professional development programs for schools as well. In 1993, for example, a series of ten live interactive programs on *Managing for Quality* was received by 300 participants across Australia, including 66 principals in the Rockhampton region. A videotaped version will be transmitted in March 1994. OTEN is producing about four hours of original programming per week.

The TSN11 network in Queensland, operated by the state government, goes to about 300 public and semi-public sites, including several state schools. In recent times there have been fewer than 10 hours a week being produced, mainly because there is no contiguous network on the ground for any specific group of users. However, new developments indicate that all Open Learning Centres are being provided with receiving dishes, all major hospitals in Queensland will be acquiring receiving equipment and moves are underway in the Education Department to review the use of satellite as well as other technologies for school applications.

Four of the state based satellite providers and carriers (Qld, NSW, Victoria and WA) have started to collaborate on national delivery of professional development and other kinds of education and training programs and could prove to be a more affordable option than Skychannel in the near future, probably during 1995-96.

Educators and trainers should keep a watching brief on these developments and be prepared to respond in terms of acquiring the receiving equipment in their schools as programs become available. Reports from the Victorian and NSW Ministries of School Education indicate that a number of schools have already done so independently. The main issue here is the lack of advisory information for schools with regard to the acquisition of equipment to ensure both compatibility and flexibility. It should be noted, for example, that satellite receiving dishes need to be purchased with a 'steering' mechanism so that the dish can be rotated, repointed, to the various Optus satellites. For example, TSN11 and the ABC transmit via different satellites.

The design and conduct of teaching/learning programs using the interactive satellite delivery option requires not only pre-production and some professional assistance, but requires certain protocols and techniques to ensure effective participation by all those attending the various sites. The key elements to making the programs successful are the opportunities for interaction at the local site level and through the telephone line to the presenters at the originating site, but even more importantly through the effectiveness of the local site facilitator in providing local 'wraparound' for the participants/learners. The National Universities Teleconferencing Network (NUTN) in the USA has produced a set of standards for the application of interactive satellite television.

It is predicted that in the near future there will be an increase in the adoption of a 'subscription model' based on a fee per site (on a sliding scale, if necessary, depending on the size of the school/community). This is due to the devolution of authority and budgeting to schools in the state systems. Schools will then be in a position to determine which curriculum or professional development programs they wish to subscribe to and bring into the school. It may then also be up to the school to act as a local broker to resell the seats to local participants to recoup the fee and, perhaps, make a profit. This model is very common in the USA and Canada where schools and school districts subscribe to a satellite service to ensure a complete coverage of curriculum subjects for all their students. This option is used when the number of students who wish to take a specialised subject (eg Latin or Advanced Physics) is too small to warrant employing a full time teacher. One example of this type of service is the TI-IN network which has 16 full time teachers teaching over four channels transmitted out of San Antonio, Texas. During the summer months, particularly, the same infrastructure is used to provide staff professional development on a subscription basis and national programs using the best expertise available can cost about $12 per teacher for a full day workshop.

With satellite receiving dishes and other necessary equipment costing about $3000, it is feasible for a school to acquire these. However, at this stage there is very little school level curriculum being delivered via satellite and professional development programs are just beginning to be developed for this form of delivery. It is expected that satellite delivery will grow significantly over the next two to five years.

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3.1.5 Analogue videoconferencing

This mode involves full motion interactive visual and audio communication using television systems such as optical fibre or cable, satellite, microwave, infrared or VHF radio signals to transmit the signals. Bridging more than two sites is usually difficult without very sophisticated switching equipment. The advantage of this form is that high quality video is transmitted.

The Catholic Education Office, Canberra and Goulburn, has now put in place a new initiative: Secondary Open Learning Access Network (SOLAN). This project is based on microwave technology which provides interactive videoconferencing at a reasonable cost to five systemic and three non-systemic Catholic High Schools and Colleges in the ACT. It provides an interactive teaching network that enables schools to access and share specialist educational offerings using distance learning techniques.

Another example is in Queensland where the Open Access Centre is trailing in the Central Region the use of VHF radio to transmit interactive videoconferencing. The range is up to 120 kilometres and it is literally free aside from the basic equipment. Users require an amateur radio license to transmit.

3.1.6 Compressed videoconferencing

There have been three major developments in recent years which make videoconferencing a feasible option for education. Firstly, the development of codecs (coder-decoders) enable the video signals to be compressed. A codec is computer-like in that it digitises the video input, compresses it and then transmits it via the ISDN network, a special service of the telecommunication carriers using the telephone network. The process allows the video signal to be transmitted along the equivalent of one or two telephone lines, whereas the normal analogue video which we see at home requires bandwidth equivalent to 1200 telephone lines. This compression saves cost and permits considerable flexibility with regard to the place and time for teleconferencing because it is much like a dial-up telephone call. Secondly, videoconferencing bridges now permit several sites to be linked simultaneously, like audioconferences. Finally, it is possible to link all forms of video devices (cameras, vcr, graphics scanners, etc) and computers through the technology.

Compressed videoconferencing may operate either on a point-to-point or multipoint basis where sites can be bridged through a 'Multipoint Control Unit' (MCU) (See diagrams, p 21). There are about 200 compressed videoconferencing sites in Australia and of these over 100 are in educational establishments. The number of sites will likely double by the end of 1994.

The Queensland network comprises 23 sites of which four belong to the Queensland government, four to the University of Central Queensland and 15 to the TAFE sector ('Videolinq'). During 1994 a trial involving Doomagee linked to Cairns and the NT Tanamai Network is underway. One application by the Education Department has been for interviewing principals for promotion without flying them to Brisbane. This system will be available during 1994 for trailing but there are costs involved for users outside of the TAFE system.

South Australian TAFE has the most well established network of 11 sites and 40 to 50 hours of training are being delivered per week. It has proven very successful in a range of courses, including both theoretical and practical skills development. The deaf have also found it a powerful way to communicate 'face-to-face' over distances using sign language.

Western Australia has also been considering a network of videoconferencing terminals and these will be associated with their 23 community 'telecentres' or open learning centres which are being combined with the telecottage concept (where people from the community can export work through the various technologies).

The cost of terminal equipment has been dropping rather dramatically. A 'room' system comprising a codec (coder-decoder) with video monitor and related equipment was between $100,000 and $150,000 during 1990-92. In mid-1993 this has dropped to about half that amount and is destined to drop even further over the next couple of years.

A more dramatic development in mid-1993 has been the introduction of both IBM and Apple Macintosh computer-based videoconferencing systems at a cost of about $13,000. These will become more widespread than the room systems and eventually form the basis of a totally integrated work and home communications unit. There are two limitations of the desktop videoconferencing systems at present: firstly, they operate on only a quarter of the size of a normal screen, even when projected on the large screen, and therefore provide a rather small picture suitable for only two or three people to view at a site; and secondly, most are not yet compatible with the room systems. The technology is expected to improve significantly over the next two years.

There are no consistent charges yet with regard to the use of site facilities, but in Queensland the fee has been set at $200 per site per hour. The line charges are twice the STD and ISD rates or about $70 per hour for the maximum distance in Australia and about $400 per hour for oveseas links. The bridge fee for 3 or more sites to be linked is $75 per port (line in) per hour.

Although the same kinds of techniques apply to compressed videoconferencing as to audioconferencing, there are many more possibilities for immediate visual inputs (graphics, slides, vcr, computer) as well as audio (eg telephone link in, audio tapes, etc.) so that preparation of programs can be more extended and require more resources if a range of these options are to be properly exploited. On the simplest level, however, it is possible to simply show up and talk to each other or hold a meeting as if everyone were in the same room.

An application which is becoming common is the use of compressed videoconferencing to bring into a state or national conference a guest speaker from overseas. This can be achieved for about $400 per hour for line charges, plus any charges for the use of the facilities at each site. By using large screen projectors and wireless microphones linked into the PA system it is possible for anyone in a large audience to ask questions directly of the presenter.

It is also possible to combine the use of compressed videoconferencing and interactive satellite videoconferencing. This has the advantage of being able to bring into a program either a guest presenter from somewhere in Australia or overseas, or to have a panel of specialists or participants in a number of sites which can see and hear each other and for that interchange to be then transmitted throughout the country, with the option of telephone interaction still available from those sites. Obviously, the more complex the technical arrangements the more costly the episode becomes and the more difficult it becomes to organise and control.

At the present costs and level of technological development it is probably not feasible for most schools to consider purchasing this type of technology in the short term, although at least one school in WA has put a system in place. It should, however, be a consideration if the computer-based audiographics equipment is purchased to ensure migration to videoconferencing in the near future.

Having clarified these various types of teleconferencing, it is now necessary to say that all of them are converging onto the microcomputer so that one reads of desk-top teleconferencing of all kinds being a reality. This is the result of video codecs, digitised audio and ISDN access being based on computer chips and cards. When that configuration is combined with satellite transmission and large-screen projection devices it is predictable that dial-up, multi-point, multimedia teleconferencing will be widely available within the next five years or so.

3.2 Computer-meditated communication (CMC)

There are at least five different types of service relevant to principals, their professional associations and schools, generally, that can be made available through such a system:

- electronic mail (email),
- bulletin boards,
- database/library access,

- computer-text conferencing, and
- file transfer.

Computer-text conferencing and audiographic forms of CMC have been discussed briefly above as forms of teleconferencing.

For organisational communications, email and bulletin boards are effective and inexpensive means of communications. Also, the asynchronous nature of the communication means that busy people can dial-up when it suits them to receive/send messages. In schools this is particularly important to overcome the timetable and timing problems inherent in synchronous teleconferencing systems. For principals this would appear to be an ideal form of communication for both formal and informal networking.

Through existing networks (eg Nexus, AARNet and Internet) it is possible now to access libraries anywhere in the world, to subscribe to electronic journals, to enrol and take courses from a number of universities and, to a limited extent with specialised access and software, to engage in real time videoconferencing.

3.3 Interactive Multimedia (IMM)

IMM courseware incorporates computer-based delivery of information in a range of forms which may include: text, graphic, sound, video (still or full motion), hence the 'multimedia' descriptor. It also usually provides the user with a range of ways of interacting with the material it contains and provides responses to user input in a manner appropriate to that input and the objectives of the material, hence 'interactive'. There are several ways in which this type of program can be stored and delivered such as laserdisk, CD-ROM and CDI as well as on hard disk drives and online servers.

4. CRITERIA FOR CHOOSING DELIVERY OPTIONS

The choice of technology delivery options should be based on four decision-making considerations:

- needs of the learners
- objectives of the program and nature of the content
- choice of the provider/presenter/teacher
- feasibility of the options

The detailed criteria for determination of technology are as follows:

Needs of the learners

Personal needs: age, gender, abilities, learning styles, nature of employment and work patterns, nature of isolation, special personal needs, home responsibilities.

Access needs: location, distribution (geographic), disability, number (total and configuration of distribution), fees/costs to the learner,

Choice: types of programs/courses available, place, pace, time, timing, duration, individual or cohort preference.

Objectives of the program and nature of the content

Interaction and participation needs: level and type of interaction required among students and lecturers such as live (ie synchronous immediate/real time) versus delayed (asynchronous) interaction, level and type of student supervision required, optimum class size,

Content needs: need for audio, need for visual component, eg still graphics, colour and motion; type of knowledge, skills and attitudes needed to be acquired and demonstrated by the learners.

Choice of the provider/presenter

Lecturer's choice of mode.

Lecturer's confidence and skills in courseware design and modes of delivery.

Support for the lecturer.

Feasibility of the options

Access to equipment and systems for production and delivery.

Costs and availability of funds for production and delivery.

Local support for learners (eg tutoring, learning centres, information).

Institutional support (eg library services, production services, administration services).

Regardless of the sophistication of the technology, the quality of courseware and/or the quality of the educational experiences supported should be the major determinant for the implementation of any technology.

5. APPLICATIONS OF DELIVERY TECHNOLOGIES

There are many other terms in the literature referring to telecommunications, teleconferencing and technologies which really indicate types of applications rather than distinct types of teleconferencing. The prefix 'tele' is being added to many other words now to indicate the technology forms of communication: for example, **telemedicine, telework, telecommuting, telelearning, tele-training, tele-education, tele-meetings, tele-interviews, telemanagement,** just to name a few.

Applications can be thought of in six categories:

- **Education/training:** that is, active teaching and learning. With interactive technologies it is possible to import education and training to the learning setting (eg the principals' home, office or a learning support centre) as well as to export it ('distance teaching'), although the distinction between internal and external studies is now becoming a moot point. Furthermore, interactive technologies can empower learners to send as well as receive and to initiate their own professional peer-to-peer self-help links. With regard to professional development, using various delivery technologies not only facilitates equity of access to activities, it also can ensure the viability of some programs through economies of scale over a greater number of schools. Principals in small schools in the far north Gulf area of Queensland meet via audioconferencing every week on a Thursday afternoon to discuss common issues and provide peer-to-peer support. Professional development for teachers in Victoria is delivered by interactive satellite television on a regular basis. Edith Cowan University provides about four hours of teachers' professional development via satellite television every Friday.

  It should be mentioned here also that the use of the same infrastructures can apply to the sharing of common curriculum components and expertise. That is, expertise in one school or system can be used through the technology to deliver curriculum to students in other schools or systems; students themselves may also network and cooperate in their learning. For example: a music teacher in a Catholic primary school in Bundaberg has been teaching music via audioconferencing to children in another school in Monto; a high school mathematics teacher in Longreach is using Macintosh based audiographics to teach a single year 11 student in Winton; students all over Australia with access to 'Computer Pals Around the World' have been engaged in cooperative environmental projects; students with access to Keylink and Nexus electronic mail have interacted with Children's literature authors; Interactive Satellite Television is being used by schools in a number of states for the delivery of Japanese language.

- **Administration/management:** this includes meetings, interviews, briefings, project management, curriculum planning and development, product promotion and courseware production, etc. Administrative groups, committees and project teams are finding interactive technologies result in greater productivity and significant cost savings when used effectively. Professional associations with widely distributed membership have found that members can not only receive better services but can become involved in the activities of the association regardless of location. Communications technology can assist in

networking people, eg principals, beginning teachers, teacher-librarians, computer specialists, etc, who have common goals or needs with a view to coordinating their work and providing specialist and peer-to-peer support. It can also assist in the senior administrators of systems providing briefings on policies and developments; for example, the Director of School Education in Victoria uses interactive satellite television to brief principals and teachers across the state simultaneously on policy developments. Regional directors of education in Queensland have met by audioconferencing for a number of years.

- **Services**: support services from specialists for such things as guidance, health services, legal advice, social and welfare services, counselling, advisory assistance, emergency services and information, eg databases, can be improved through the use of technologies. Expensive resources or services can also be shared among cluster schools and this would be applicable to both students and staff. School advisers and counsellors in a Queensland region link via audioconferencing with specialists in Brisbane to obtain guidance in testing of students in remote area schools. This can have important implications for the way in which principals can access support services for themselves and their schools.
- **Resources**: schools with access to the Internet can use remote library catalogues, subscribe to electronic journals, access databases and download teaching resources materials and software.
- **Research**: data collection (eg interviews), cooperative action research, exploratory analysis, assessing and processing outcomes, many with a view to educational improvement, have all employed these technologies. Principals and teachers have used these technologies to implement cooperatively new curriculum and policy developments.
- **Social/entertainment**: sports coordination, social interchange, games, family meetings, especially for special occasions, and general entertainment can be facilitated. Although not specifically applicable to principals' professional development, this is nevertheless an area of application.

Each of these areas of application can be subdivided and described in almost endless detail, but the important thing is that each of these five areas have a special set of techniques associated with the effective application of interactive technologies, particularly teleconferencing.

WORKSHOP REPORTS

Tuesday: Education

Group 1 - The Community and Contextualised Schooling: Processes and Principles

1. Governments and education systems should give priority to reknitting schools and the rural communities which they serve.
2. This Conference challenges the notion of curriculum as sacred cow. Curricula should be formed by the community in conjunction with professionals rather than having it delivered by the professionals.
3. Students should be active developers of the curriculum rather than being passive recipients.
4. Schools are a vital part of rural communities.
5. Local community knowledge and information should be incorporated into curriculum.
6. Support should be provided for teachers to help them learn how to weave local knowledge into the curriculum and to develop new skills appropriate to this knowledge.
7. Stop the erosion of rural community values through urban curriculum.
8. Ways should be explored to loosen school organisational structures and to improve the ways teachers interact with students.
9. Standardised testing does not allow rural students to display their abilities and achievements. Such tests are therefore another way in which urban values dominate rural students.
10. Opportunities should be provided for rural students to celebrate their achievements.

Group 2 - Access to Resources and Resource Sharing

1. Undergraduate courses should address rural issues.
2. Alabama Health Fair processes should be used across many professional areas in rural communities.
3. Mobile early childhood resources should be available in rural communities.
4. School networks/clusters should be established to support teachers in rural schools.
5. Education/Health professionals should establish community evenings for interacting with the community.
6. Parent development officers should be appointed in rural communities to assist parent groups.

Group 3 - Education and Training for Rural Teachers and Professionals

1. Teacher education courses need to develop skills to deal with change (personal, professional, practice, bridging courses pre-in-service).
2. All preservice teacher education courses should include exposure to current rural practice.
3. Universities should provide alternative entrance criteria for rural people. Measures other than TER should be used, and mature age entrants should receive credit for life experience.
4. Program delivery modes that provide rural people with easy access should be developed.

Group 4 - Rural Isolation: Technologies for the Delivery of Education and Training

1. That the definition of a standard telephone service be extended to include an adequate standard of data capability to include digital services and that systems be continually upgraded to ensure that rural and remote residents do not fall behind the standard services offered to urban residents.
2. The Conference encourages the federal governments to establish infrastructures for communications technology in rural and remote services as a social responsibility. This is seen as a prerequisite to any form of education, training and service delivery. The infrastructure should be built in such a way as to allow information to be shared among rural communities.
3. The Conference recommends that the Education, Health and Community Development sectors represented at this Conference work to form a coalition with other potential users to lobby for adequate information/technology structure for rural and remote areas.
4. Recommended that the federal government allocate financial resources to the country-wide development of compatible technologies to maximise the delivery of education and training to rural and remote areas.
5. There is a need to consider a means to empower rural and remote communities to utilise technology to support their needs and create networks of sharing between rural communities.

Group 5 - Indigenous Education & Indigenous Health (Thursday)

Primary Statements

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